

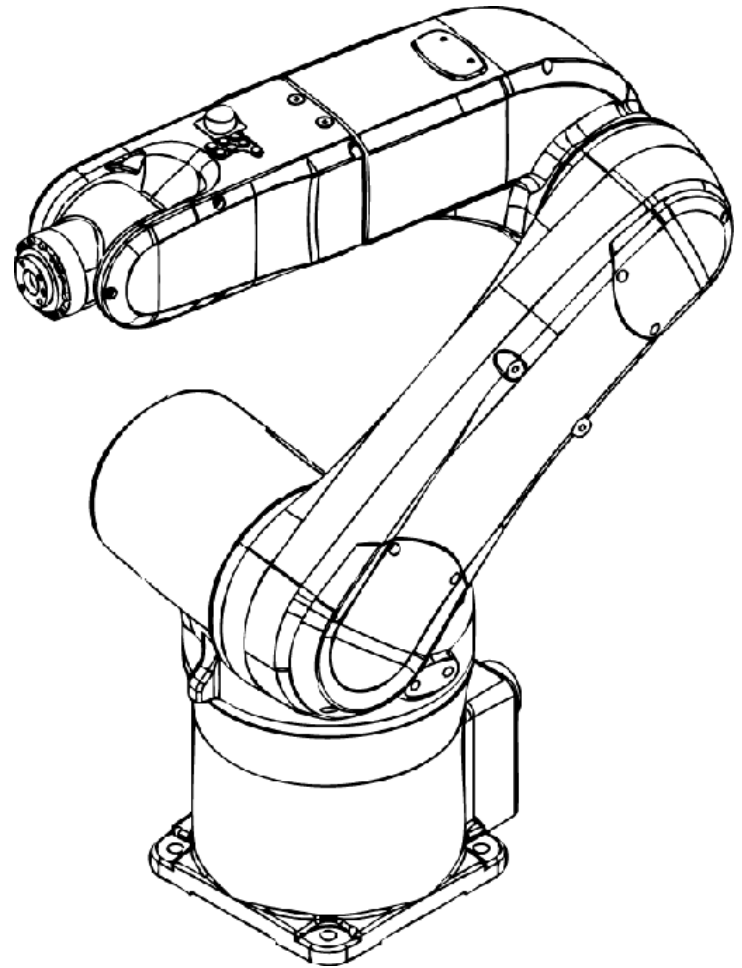
RoboShow



Team Members: Kevin Witkoe, Will Edwards, Jacob Herrington, Kyle Kausen, Andrew Gregory, Stephen Goodwin

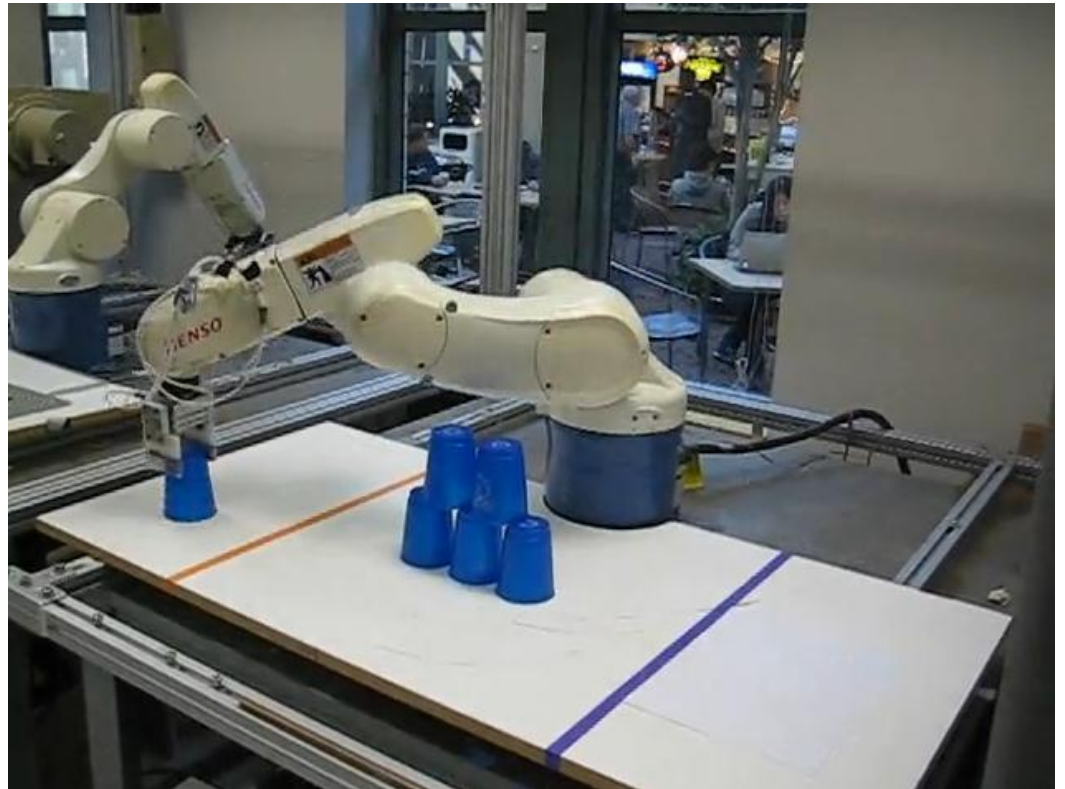
Objectives

- Build an enclosure that conforms to all OSHA safety standards for autonomous robots.
- Create a signature demonstration exhibit for the College of Engineering
- Create a robotic workstation for research and education



Deliverables

- Safety Enclosure
- Robot Control
- End Effector



Timeline

- Product Design Reveiw – 11/13
 - Finalized design options
 - Software downloaded and investigated
- 2nd Snap Shot – 12/6
 - First enclosure assembled
- Portfolio – 12/13
 - Robot movement
- Final Design Review – 2/3
 - End Effector Design Approved
 - Robot Demonstration of Complicated Maneuvers
- 3rd Snap Shot – 3/11
 - End Effector Prototype
 - Integration of End effector and Robot Arm
- Engineering EXPO – 5/2

Enclosure Specifications/Constraints

- Relatively mobile
- Industrial standard safety features
- Modular
- Integrated controller storage
- Fit within freight elevator
 - Max dimensions: 46" x 84" x 78"
- Arm must fully extend in X, Y, and Z directions
 - Full extension includes length of the end effector
 - Arm radius: 34"
 - Arm max height: 43"

Safety Requirements

- Emergency stop button
- Door with auto-shutoff when open
- Fully enclosed
- User interface

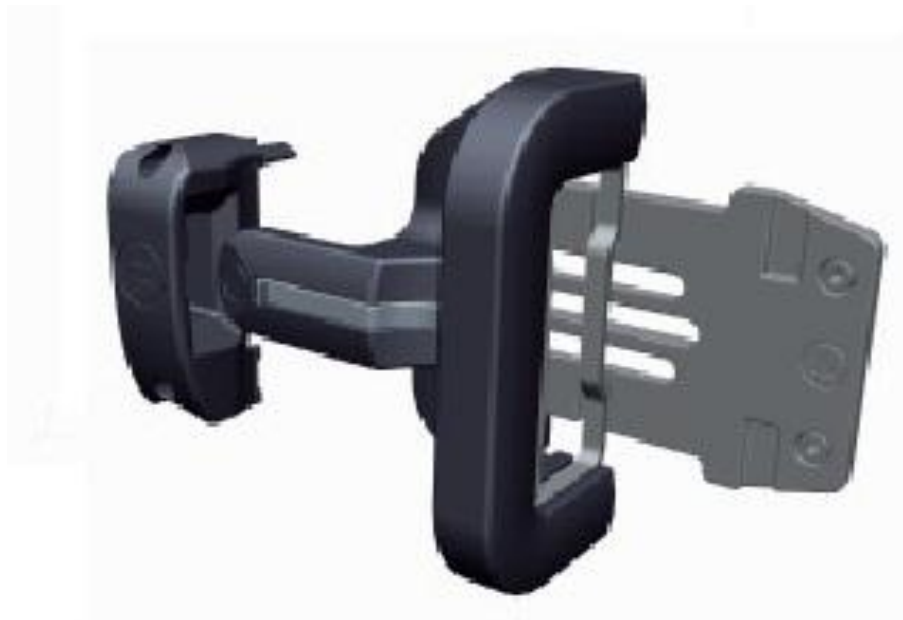


eGard



- User Interface
- Up to 9 components
- 4 Billion combinations
- Made up of a core, head, and base

Head Actuator



- Comes with a head actuator which turns the robot off when the door opens

Core



- On/Off key



- Emergency stop button with reset



- Start/Stop button



- Selector switch

Base

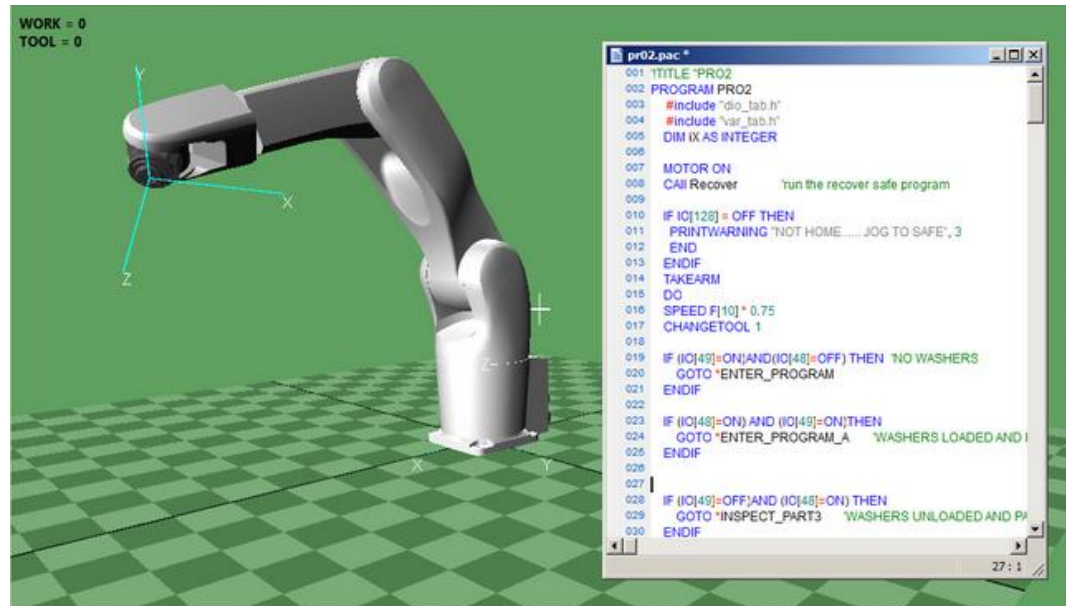


- 14 pin Control and Safety connector with 8 I/O



WINCAPS Software

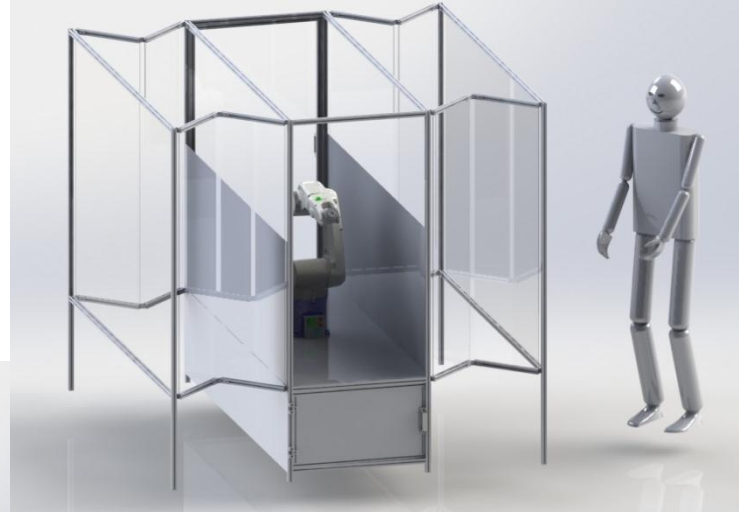
- 3D simulation
- Absolute and relative motion control
- Import CAD models
- Collision detection
- Cycle time



Design #1



Open

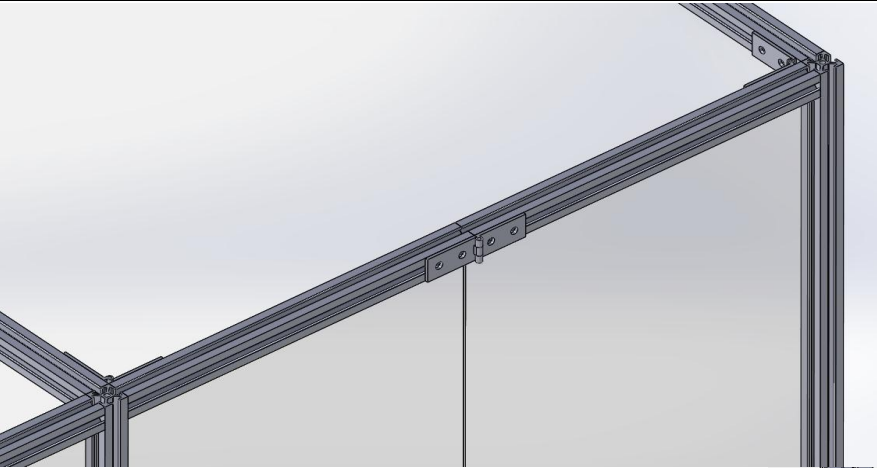


Folding

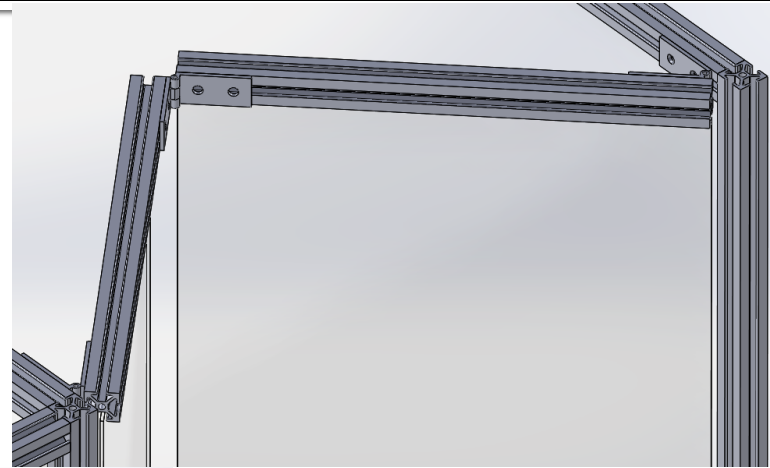


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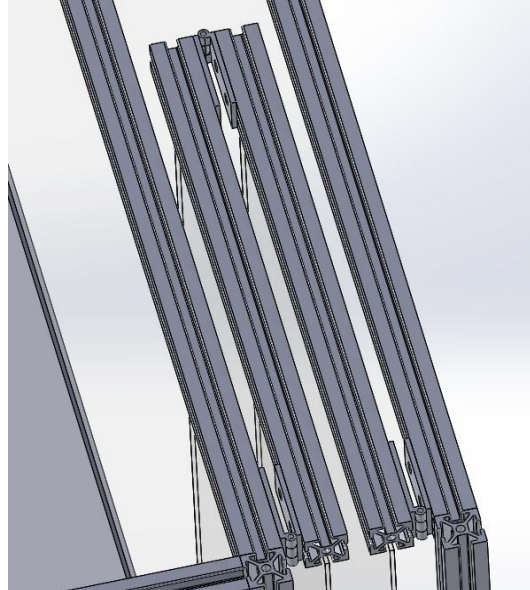
Design #1 - Hinge Views



Open

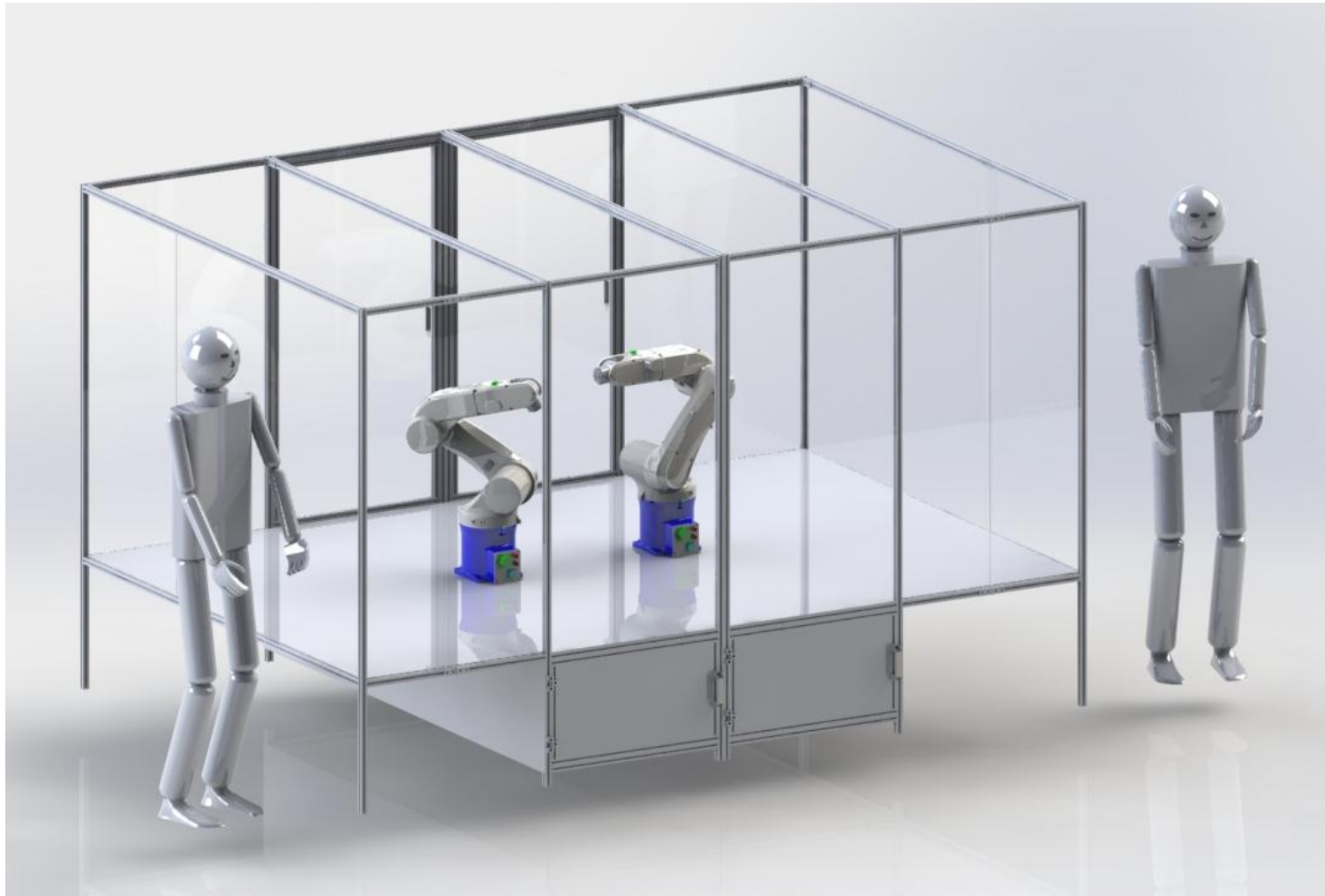


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Design #1 – Combined Enclosure



Combined Enclosure

Design #1 – Pros and Cons



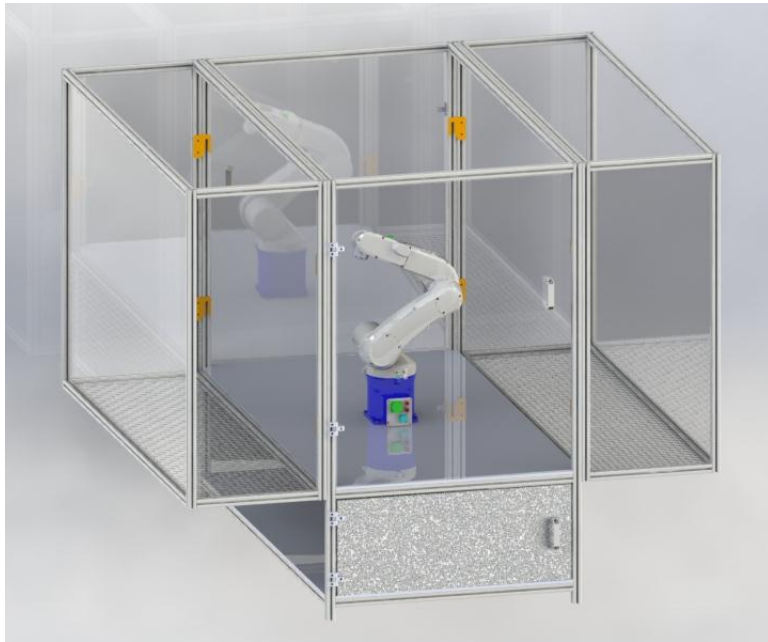
PROS

- Easily portable
- All electronics in same unit
- Fewer safety connection switches
- Combined workstation has large shared workspace

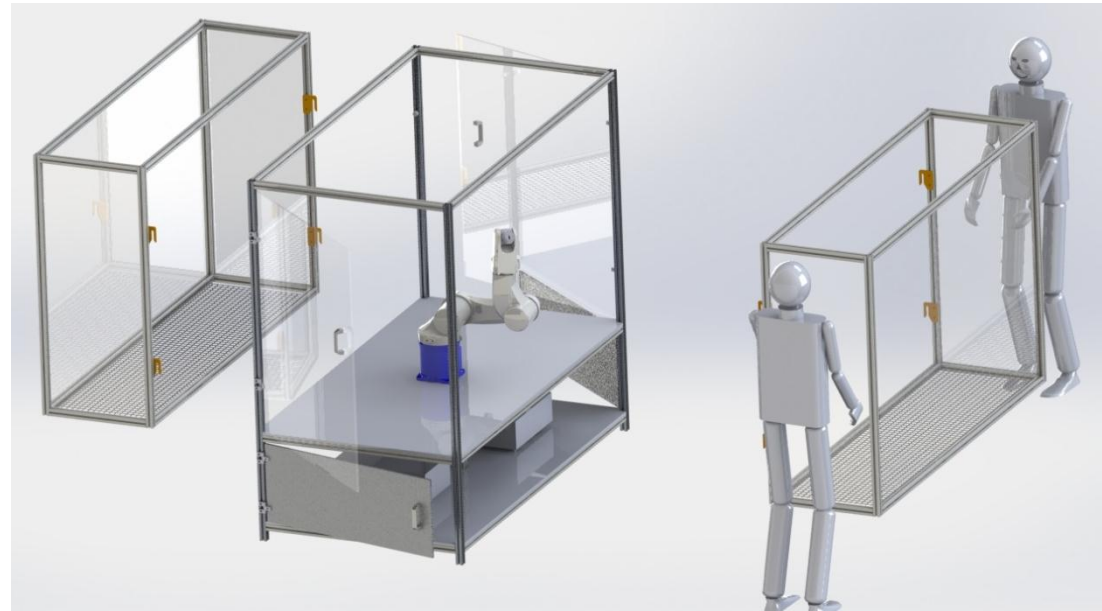
CONS

- Reduced storage
- Difficult to open and close because of parallel links
- Moving parts
- More points of failure
- Disassembly required for combined workstation

Design #2

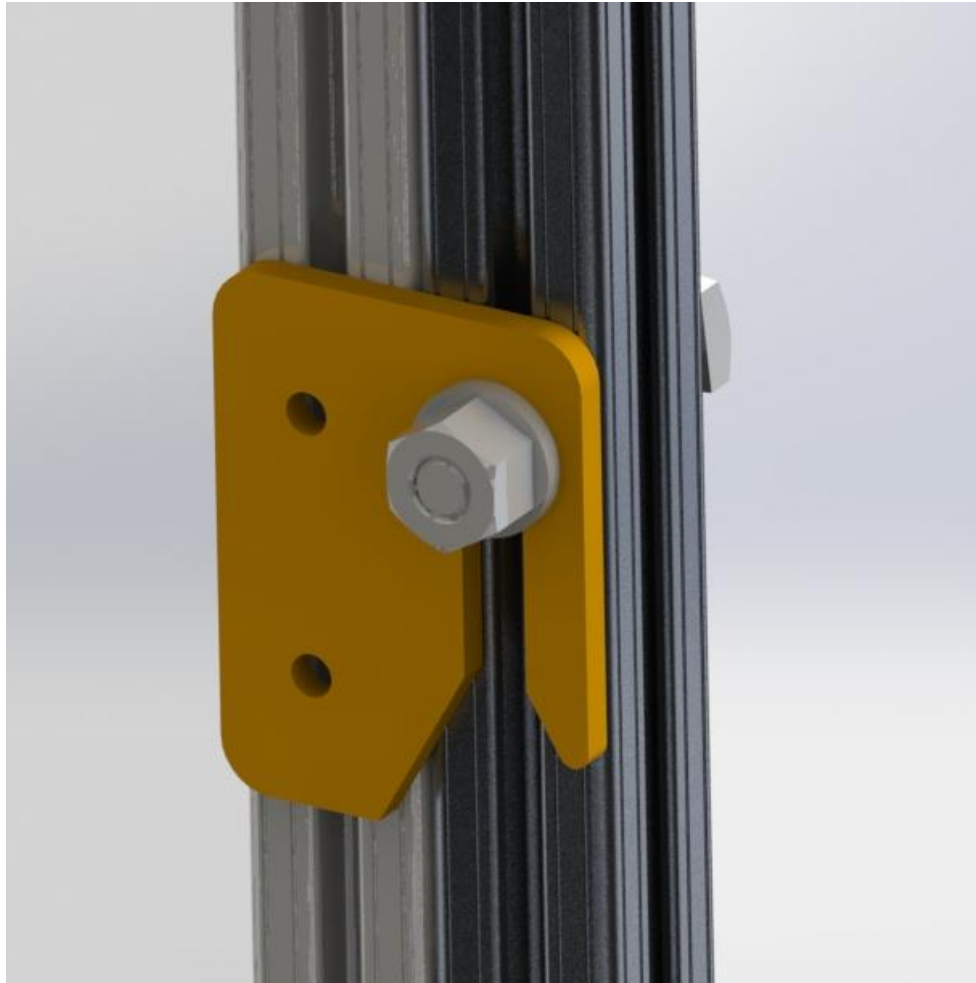


Attached



Detached

Design #2 – Connection View



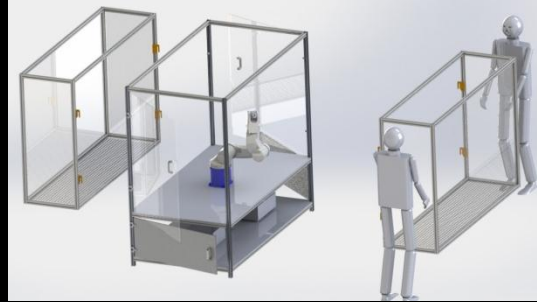
Connection

Design #2 – Combined Enclosure



Combined Enclosure

Design #2 – Pros/Cons



PROS

- Easy expansion to combined enclosure
- Larger storage space
- Easily portable
- Simple design

CONS

- Three separate pieces
- Must lift off attachments
- Requires more than 1 person to lift sides

Budget

- Software (WINCAPS and pendant)
 - \$3300
- Safety features
 - \$1200
- Two Enclosures
 - Polycarbonate for one: \$5600
- End effector
 - \$1000.00
- Total estimate (not including tax or shipping)
 - With polycarbonate: **\$11100**

Questions